SENATE AGRICULTURE
EXHIBIT NO. 19
DATE 3-17-09
BILL NO. HB 445

MONTANA
STATE UNIVERSITY
College of
AGRICULTURE
&
MONTANA AGRICULTURAL
EXPERIMENT STATION

March 14, 2009

TO: Senator Don Steinbeisser
Chair, Agriculture Livestock and Irrigation

FR: Jeff Jacobsen
Dean and Director

RE: HB445

I have been asked on numerous occasions if there was any potential impact of HB445 on research programs at Montana State University (MSU). It is my understanding that this bill is before your Senate Committee. Although I am not in a position to speak globally for MSU, as Director of the Montana Agricultural Experiment Station (MAES), an agency with statewide research responsibilities for plant and animal agriculture, I can provide some context. The short answer to these inquiries is yes, supported by my description below.

MAES actively participates in plant research, whereby the end result is an improved plant variety, typically of winter wheat, spring wheat and barley. These are our primary plant breeding and genetics programs, although we also have smaller plant research development programs in oilseeds, grasses and forages. With wide grower and allied industry support, we have implemented, the standard of plant variety protection (plant patents) for all of the MSU-MAES released varieties. Nationwide, we are now in the mainstream relative to our public variety release program. In addition, we routinely collaborate with allied agricultural partners on cropping system and pest management programs that utilize licensed or patented diversified crop plants (e.g. seed, unique genetic traits).

With the above brief background, I am concerned on the negative consequences of HB445 on our competitive research programs in MAES, particularly in the bill sections that address 'patented plants' and related components. MAES develops patented plant materials to benefit Montana farmers. As written, MAES would be the patent holder, partner with allied patent holders and farmer. Sections of HB would limit our competitive research programs in MAES and, consequently, impact the competiveness of Montana farmers.

In addition, I have enclosed a copy of the recently developed Montana Science and Technology Plan that has been developed by the MUS System in partnership with diverse Montana entities. Imbedded in the Plan are plant (and other) research thrusts that would be in conflict with sections of HB445.

Feel free to contact me if you desire further information on this topic. Good luck in your deliberations.

Office of the Dean and Director

202 Linfield Hall
P.O. Box 172860
Bozeman, MT 59717-2860

Tel (406) 994-3681
Fax (406) 994-6579
http://ag.montana.edu

Montana Science Serving Montana Citizens

Montana University System
January 2009

socially responsible science and technology in higher education and related enterprises

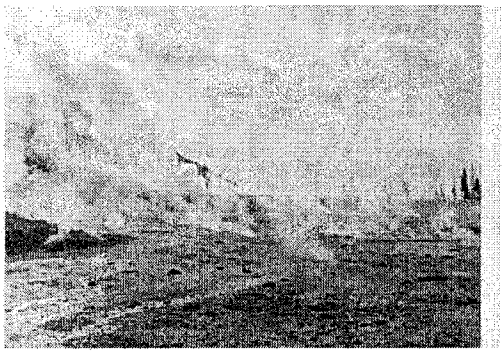
Five major research areas are the core focus of this *Plan*:

- Energy Sciences and Engineering
- Health and Biomedical Sciences
- Agricultural Science
- Science of the Environment
- Materials Science and Engineering

[1] *Business Week.com* on October 16, 2008 recognized Montana State University as one of "10 lesser-known schools making their mark in tech development."

Faculty, staff, and students in the Montana University System (MUS) are engaged in science and technology research and graduate education that helps build Montana's economic future. The MUS research enterprise also builds partnerships with communities, businesses, and other educational entities to help align science education and research with pressing social and economic challenges. The science and technology research community takes seriously its role in preparing future scientists and teachers, and in contributing to science literacy for Montana citizens.

Montana research has national and local significance, numerous and important practical applications, and demonstrated potential for commercialization. Despite a relatively small population base, Montana is rapidly gaining recognition as an emerging national leader in transforming basic science into marketable technologies and products, and in using scientific research to solve regional and global problems in environmental, energy, and other fields.[1] Montana's future will depend on investment in research as a way to develop products, technologies, and businesses that are resistant to economic fluctuation, and to try new approaches, such as renewable energy sources and sustainable agricultural, to improve our quality of life.



Research programs in the MUS contribute to economic development in Montana by:

- Serving as the largest research and development enterprise for our state with total research expenditures in excess of $170 million and close to 90% of that amount arising from successful competition for federal grants from numerous agencies;
- Preparing graduates who have experienced the complete integration of learning and discovery, have had access to state-of-the-art equipment (most purchased by research grants), and are ready to enter the knowledge economy and to work for technology-based companies;
- Offering numerous business assistance programs including the Montana Manufacturing Education Center, TechLink, and others that provide hands-on assistance to manufacturers and other high-tech businesses;
- Supporting technology transfer through licensing of discoveries for commercial applications that lead to new Montana technology-based companies whose employees earn an average of $53,000 per year whereas the average salary state-wide is just over $30,000; and
- Attracting new companies to Montana because of the workforce and supportive technology climate provided by the Montana University System.

Montana Science Serving Montana Citizens is intended as a statewide science and technology plan for higher education and related enterprises in Montana. The *Plan* will help identify priorities for the MUS and the State of Montana in the allocation of resources to a research enterprise that has great potential to grow and flourish. The *Plan* is based on research already underway and also outlines new directions for research as Montana looks to its future.

Five major research areas are the core focus of this Plan:

- Energy Sciences and Engineering
- Health and Biomedical Sciences
- Agricultural Science
- Environmental and Ecosystem Science
- Materials Science and Engineering

Regarding these five major research areas, multiple studies have concluded that the convergence of global warming, global economic and social integration, and population pressure is the most important dynamic shaping our world today. The term the "Energy-Climate Era" has been used to describe the historical epoch caused by this convergence.[1] On a national and international scale, we need a huge investment in research and development to solve the problems facing the world today.

"Professor Steve Running at The University of Montana was one of the co-recipients of a Nobel Prize for his contributions to the field of climate change..."

"the convergence of global warming, global flattening and global crowding is the most important dynamic shaping our world today."

[2] *Friedman, T. Hot, Flat and Crowde. 2008*

Energy Sciences and Engineering

Decades of unprecedented growth in population and an apparently insatiable desire for energy has created a demand for new energy production that far exceeds supply, resulting in record high energy costs. Although these demands have waned with the current economic decline, it is virtually guaranteed that economic recovery will re-establish huge demands for energy.

Critical energy research programs (many already underway under the auspices of MSU's Energy Research Institute and the UM Numerical Terradynamic Simulation Group) include both improving the efficiency of using carbon-based resources for years to come as well as identifying and optimizing new sources of energy.

"Decades of unprecedented growth in population and an almost insatiable desire for energy has created a demand for new energy production that far exceeds supply..."

Reducing the environmental impact of burning fossil fuels

- Understand the interactions and implications of storing CO2 underground, including fluid flow models, mineral interactions, bio-containment, detection and monitoring, and catalytic recycling of burned carbon;
- Restore and remediate environmental damage caused by fossil fuels extraction and burning, including climate change and related policy implications;
- Convert coal to chemical and fuel stocks through direct microbial action.

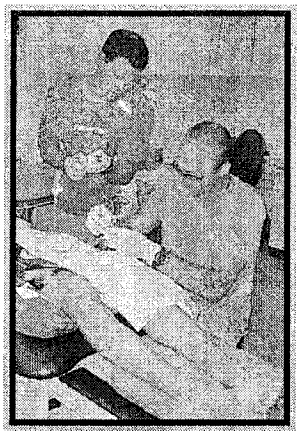
New Energy Initiatives

- Enhance **fuel cell and battery performance and affordability** through the identification of new materials that can operate at high temperature, are less susceptible to poisoning, demonstrate greater fuel flexibility, and do not require expensive precious metal catalysts. Improved batteries in next generation vehicles will require new materials, better diagnostic instrumentation, and increased range. Fuel cell practicality will require reliable hydrogen sources, better catalysts, and realistic storage and delivery mechanisms.
- Foster **wind power** as a significant contributor to energy needs by focusing research on development of more efficient turbine blades and the effective use of small scale (e.g. single family) use.
- Focus **Bio-fuels Research** on improving oil production and quality from crops and non-crop sources (including algae and other microbes) through plant biotechnology, increasing the efficiency of refining bio-fuels and converting biomass into bio-fuel, and optimizing the operation and longevity of engines that run on bio-fuels.
- Expand the use and diversity of alternative sources of bio-fuels, including algae and cellulosic ethanol from non-crop species.

Health and Biomedical Sciences

Health and biomedical research within MUS is focused on improving health care for Montanans. Strong outreach and research programs are addressing health care disparities in our rural state while world class biomedical research carried out on Montana's campuses is linked with translational research implemented in partnership with Montana's hospitals. Montana researchers work to find new ways to prevent, detect, and cure a variety of human maladies such as emerging infectious diseases, respiratory illnesses, stroke, cancer, cardiovascular disease, prion disease (mad cow), and others. It is critical that Montana continues to invest in health sciences and biomedical research in broad areas, including:

- *Neuroscience* - fundamental and translational research involving chemistry, biochemistry, pharmacology, toxicology, and molecular biology to advance our understanding of protein structure and function in the central nervous system, particularly as related to signal transduction, transport, development and pathogenesis;
- *Cardiovascular function* - fundamental and translational research into pulmonary and cardiovascular diseases, immune and autoimmune disorders, developmental defects, neurodegenerative diseases, genetic susceptibility, heart failure and vascular disease, and the impacts that environmental factors have in causing or exacerbating these conditions;
- *Infectious Disease* - research on resistance of infectious organisms, development of new treatments to combat infectious diseases, development of improved vaccines and therapeutic agents to combat infectious diseases in humans and livestock;
- *New Medicines, new therapeutic agents and new diagnostic agents* - synthesis of new molecules with applicability to health care, discovery and characterization of naturally occurring medicinal agents, understanding of drug efficacy and interactions, detection and monitoring of medicinal agents in physiological and environmental systems;
- *Health Disparity and Health Care Delivery* – research to understand health conditions that affect various populations disproportionately, focusing especially on health care for rural, indigenous, and lower socioeconomic populations in Montana.



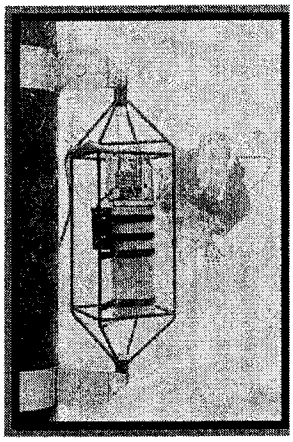
UM researcher Brent Ruby (right) and muscle sample specialist Dusty Slivka extract tissue from a leg.

Agricultural Science

With population increases and climate changes, we are witnessing a significant increase in demand for sustainable, high-quality food supplies. An additional significant factor is the increase of biotic stresses that degrade food supplies, such as pathogens and insects. The MUS S&T plan recognizes a need to substantially enhance and expand Montana's efforts to increase agricultural productivity.

Key research initiatives envisioned include the following objectives:

- Plant breeding and molecular biology approaches for increasing quality and yields of crop plants, especially cereal crops that are the staple of the worlds' food supply.
- Biotechnology approaches including genetic modification for enhancing stress resistance to both biotic and abiotic stresses.
- Expanding the use of molecular tools including biochemistry, molecular biology, plant and animal genomics/proteomics with the goals to improve productivity, quality, and resistance to climate variations and pathogens.
- Plant breeding to develop native grass strains resistant to invasive weeds.



A UM sensor deployed near a coral reef in the Bahamas (Jim Hendee photo)

Environmental and Ecosystem Science

Montana is in a unique position of having one of the most pristine environments in the nation while exhibiting significant signs of environmental stress from our history of dependence on an extractive economy. This provides both the opportunity and the responsibility to conduct leading research on our own and similar environments around the world. The challenge will be to capitalize on what the environment has to offer while preserving for generations to come the lifestyle that has become a standard of Montana living.

Key research initiatives envisioned include the following objectives:

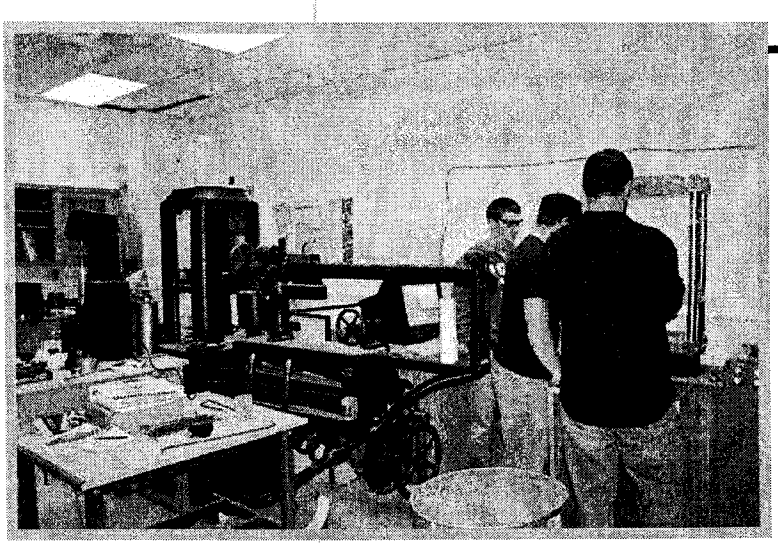
- *Monitoring of ecosystems* – to detect, understand, and predict changes that may be occurring on local, regional, or global scales. Analyzing how climate changes impact temperature, rainfall, and other environmental factors is important for future predictability of water availability, risk of wildfires or floods, food production potential, and overall biodiversity impacts. Large scale monitoring and modeling of Montana's watersheds.
- *Sensor deployment* - on an ecosystem scale for detection of climatic changes and impacts, thereby positioning the MUS to be a lead domain in National Ecological Observatory Network (NEON), assuming the National Science foundation (NSF) funds the proposed NEON program in 2010 and beyond [This will allow Montana to be a major player in the deployment of sensors , including remote sensing, that will allow for real time observation of ecosystem changes on a national network scale.]
- *Understanding and remediating disturbed systems* – important in Montana to support efforts to restore critical areas of the state.
- *Integrative studies on ecosystem levels of the behavior and response of organisms* - to natural and human-induced influence, including the understanding and management of Montana's wildlife resources.

Materials Science and Engineering

There is an ever increasing need for new materials that can solve problems, e.g. lighter weight and yet stronger materials that could lead to cheaper and safer transportation, improved materials for the electronics and optics industry, and enhanced materials to address health related issues. It is important to note that the focus on optoelectronics research at MSU has been a major factor in the growth of the optoelectronics private sector increasing from two companies in 1990 to more than two dozen today.

The MUS S&T plan strongly recommends expanding our efforts in materials science/ engineering and nanotechnology. This area has great potential for technology transfer and for directly contributing to economic development in the near term through licensing technologies to existing companies as well as the starting up of new companies like we have seen with the optoelectronics and optical materials industry. Discoveries made through materials and nanotechnology research will contribute to solving many of the problems outlined in the previous areas of the Plan. Areas of emphasis should include:

- Improving optical materials through research in physics and electrical and computer engineering
- Enhancing materials for fuel cell membranes to prevent degradation of the membranes and prolonging life and thus reducing fuel cell cost
- Using biologically inspired approaches to nanofabrication to produce new materials, including nano-materials with applications in medicine, electronics and catalysis.
- Designing and developing new composite materials for applications in the mining industry and in metal ion remediation of industrial and acid mine drainage waste streams
- Developing next generation magnetic storage devices through the use of magnetic nano-dots: magnetic disk with diameters as small as 50 nm with thicknesses ranging from 3 nm to 20 nm.



Supporting Components

- Information technology infrastructure and research is seen as fundamental in all five core research areas. Large scale computationally intensive modeling and visualization is fundamental to all five of the major research areas. Information technology infrastructure needed to support leading research will focus on computation power, connectivity, software and programming expertise, and new computation methods.
- Partnerships and collaborations among public (e.g., national laboratories or other research universities), private, and non-profit organizations, underlie many (if not most) of Montana's research efforts. State-of-the-art research increasingly will call for collaboration between the institutions of Montana's higher education system and between those institutions and others in the state, nation, and world.
- Technology transfer allows the MUS to move ideas from the laboratory to the private sector. Many excellent examples of such transfer already exist, but considerable room for growth is evident. The MUS research infrastructure not only should facilitate technology transfer, it also should encourage researchers to proactively seek opportunities for moving ideas to the market place and employing people in the high-technology economy.
- Social sciences are a necessary component in the research arena as policies and practices increasingly are drawn from scientific discovery. The scientific research community will make a concerted effort to engage social science colleagues in cooperative research and in the identification of areas in which research is necessary to meet human needs.
- Graduate program development: Graduate education and research go hand-in-hand, and states with vibrant research agendas also have thriving doctoral programs. The doctoral degree is a research-based degree, and graduate students are a mainstay of research productivity in science and technology. A concerted effort to recruit and retain the most talented graduate students from the state, region, nation, and world will pay off in research productivity and in long term economic development. Strategic growth of graduate programming through expanded and new doctoral programs will be required in areas relevant to the focus areas described above.
- Ethical conduct is integral to quality research. Researchers and their students and support staff will engage in formal ethics education opportunities. Additionally, researchers will be honest and transparent regarding any potential conflicts of interest.

- Communication will be a high priority for researchers and their students, and they will focus on high quality scientific writing and developing ability to communicate complex subjects clearly for multiple audiences. Contemporary researchers must communicate effectively not only with other researchers, but also with policy-makers, investors, and the general public. Emphasis will be bi-directional – helping scientists understand the expectations and needs of the public and helping non-scientists understand the implication of scientific discovery.

✓ Reaching Youth – MUS research provides an ideal "hands on" teaching environment where K-12 and undergraduate university students can share the excitement of discovery. As they have with past research efforts, MUS researchers and partners will strive especially to serve Montana's American Indian youth. The long-term vitality of Montana's research enterprise will depend on a healthy pipeline of interested and capable young people who pursue careers in science.

✓ Engaging Adults – MUS research has the power to excite and inform. Outreach programs on the campuses, offered through extension and other entities, can help the public participate in the thrill of discovery. Montana citizens who are excited about science will help support its long-term growth.

Montana University System
2500 Broadway
Helena, Montana 59601

Phone 406 444 6570
Fax 406 444 141469
E-mail selkins@montana.edu

Strategies for Moving the *Plan* Forward:

1) Develop a permanent funding mechanism for 'required match' dollars for research grant requests (e.g., EPSCoR) and for support of innovative campus efforts to commercialize research efforts (tech transfer);
2) Establish a fund for endowed research scholarships (maybe targeting upper level undergraduate students and graduate students) where private contributions could be matched at some percentage by state funds;
3) Hold a celebration conference (biannually or annually) on tech transfer and research in Montana to excite Montana business and political leaders about the economic impacts of investment in MUS research;
4) Strengthen and expand MUS research partnerships with Montana businesses;
5) Develop a marketing strategy for Montana "Science and Math Literacy" to include:
   - A "Transfer of Knowledge and Experience" expert pool that engages senior faculty members and senior technology business researchers and engineers in guest teaching at high schools and in undergraduate classes;
   - Experiential opportunities for high school students and undergraduates
   - Regular communications with the greater public about research and tech transfer – possibly to consider a "brand."

Montana Science Serving Montana Citizens